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Ground state energy in a wormhole space-time

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Abstract

The ground state energy of the massive scalar field with nonconformal coupling ξ on a short-throat flat-space wormhole background is calculated by using the zeta renormalization approach. We discuss the renormalization and relevant heat kernel coefficients in detail. We show that a stable configuration of wormholes can exist for ξ> 0.123. In the particular case of a massive conformal scalar field with ξ= 1/6, the radius of the throat of a stable wormhole a≈O.16/m. The self-consistent wormhole has the radius of throat a≈0.0141l p and the mass of the scalar boson m≈11.35m p (l p and m p are the Planck length and mass, respectively).